COMP 308 / COMP 223 – ARTIFICIAL INTELLIGENCE
INDIVIDUAL ASSIGNMENT
DUE: Friday 26th March 2020
INSTRUCTIONS: Answer ALL questions. Submit a hand-written copy

Local Search Algorithms: Hill climbing algorithm

1. Define the Hill climbing algorithm
2. Differentiate between local maxima and global maxima
3. What THREE problems may occur during a hill climbing search?
4. How do we deal with these problems?

Evolutionary Algorithms

5. What are Evolutionary Algorithms (EAs) and what are the components of an EA method?
6. What are Genetic algorithms (GAs)?
7. Give reasons why GAs are useful in problem solving?
8. Using a pseudo code for a genetic algorithm, describe how GAs search for a solution
9. Describe the following genetic operators as they are used for GA reproduction
   a. crossover
   b. mutation
10. Describe TWO applications of GAs

Knowledge Representation: Frames

11. Describe Frames as a knowledge representation scheme?
12. What are the components of frames?
13. Represent the following facts as a set of frames
    "Birds are animals that can fly, have feathers and are of different colours. Canaries and ravens are types of birds. Canaries can fly, are yellow in colour and can be kept as pets. Ravens can fly, are black in colour and cannot be kept as pets. Tweety and Cheepy are pet canaries and their owners are John and Mary respectively. John, Mary and Vet are people. Mary takes Cheepy to the Vet but John does not take Tweety to the Vet."

Knowledge Representation: First order logic (FOL)

14. Describe the prolog programming language
15. How does prolog inherently violate being "pure" first order logic
16. Discuss the strength and limitations of prolog

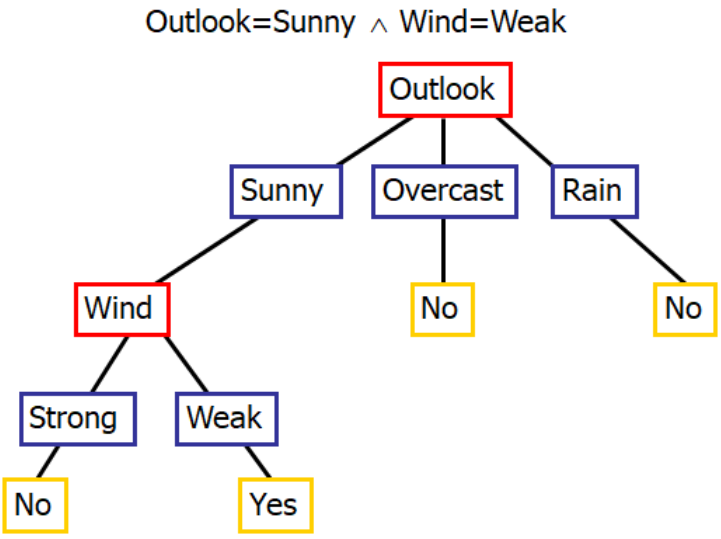
Uncertainty: Fuzzy Logic

17. How do AI systems deal with uncertainty?
18. What is fuzzy logic reasoning?
19. What is a fuzzy logic system?
20. Describe the architecture of a fuzzy logic system
21. Describe how can fuzzy logic reasoning be applied to natural language understanding

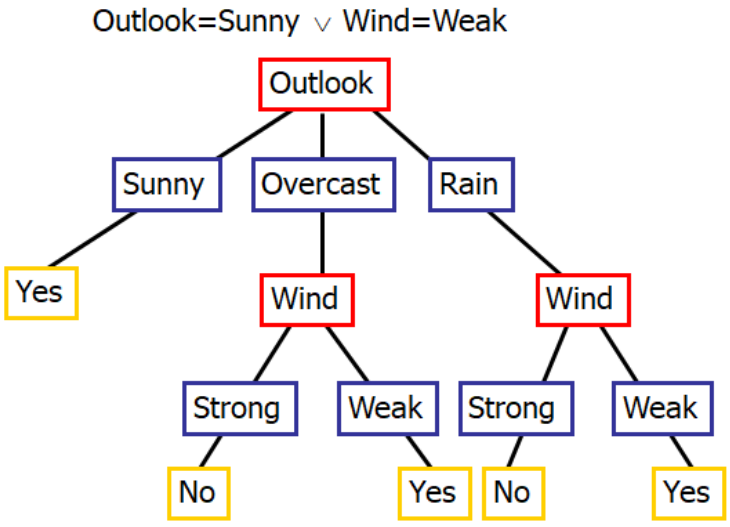
Machine Learning: Decision Trees

22. What are Decision Trees?
23. Draw and label the structure of a decision Tree
24. What are advantages of using decision trees?
25. explain problems that come with using Decision Trees
26. What is Decision Tree Induction?
27. Consider the following examples of decision trees for 'Play Tennis'.

Decision Tree for Conjunction



Decision Tree for Disjunction



Study the examples above then draw a decision tree that represents disjunctions of conjunctions based on the following statement:

(Outlook=Sunny $\wedge$ Humidity=Normal) $\vee$ (Outlook=Overcast) $\vee$ (Outlook=Rain $\wedge$ Wind=Weak)

Machine Learning: K – Nearest Neighbor

28. Describe FOUR instances when you should consider using decision trees
29. What is Instance Based Learning?
30. Compare eager and lazy learning
31. Define k-Nearest Neighbor (k-NN) machine learning technique
32. When should we consider using k-NN?
33. Describe k-NN algorithm and how it works
34. Explain the strengths and limitations of k-NN

Communicating, perceiving and acting

35. What is natural language processing?
36. Describe the stages in natural language understanding
37. Describe THREE application areas of natural language processing
38. What is Image Processing?
39. Discuss the stages of image processing